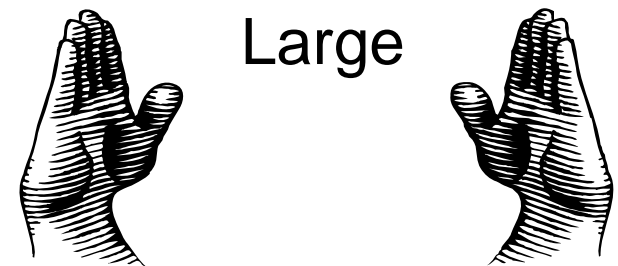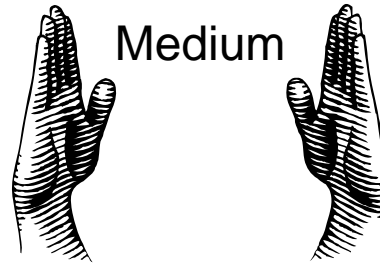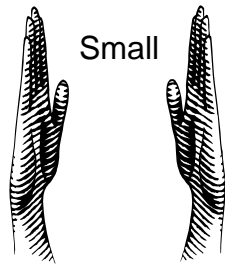# Creating a BOE
(Basis of Estimate)

Presented by: Al Glass
Software Process Improvement (SPI) Project

- **What is a BOE and why do I need one?**

- **Elements of a BOE**

- **BOE Tools and BOE Artifacts**

What is a BOE?
(Basis of Estimate)

Small   Medium   Large

- ■ **A basis of estimate (BOE) is:**

  - – **The justification for arriving at a particular cost estimate**

  - – **Includes estimating methods, approach taken, prices used, assumptions, risks ……**

Why do I need a BOE?

- **A good BOE:**
  - **Supports the cost estimate's credibility**
  - **Aids in the analysis of changes in project cost**
  - **Enables reviewers to effectively assess the cost estimate**
  - **Contributes to information for future estimation**
- **The BOE provides a project communication vehicle to increase probability of project success**
- **and…**

Why do I need a BOE? (Cont'd)

NPR 7150.2 requires it:

2.2.3 The project shall establish, document, and maintain at least one software cost estimate that satisfies the following conditions: **[SWE-015]**

a. Covers the entire software life cycle.

b. Is based on selected project attributes (e.g., assessment of the size, functionality, complexity, criticality, and risk of the software processes and products).

c. Is based on an assessment of the technology to be used and the impact on risk, cost, and schedule.

How Much Detail Belongs in a BOE?

- **A BOE should be complete enough and well enough organized to allow competent reviewers to assess cost estimate**

- **Considerations for amount of detail:**

  - **Purpose of estimate (Very early planning requires less detail than later estimates)**

  - **Size of project (Need more detail with larger projects)**

  - **Nature of project (COTS system, new technology development, reuse)**

  - **Data availability (Where less data is available, costs estimates are aggregated and bracketed by uncertainties)**
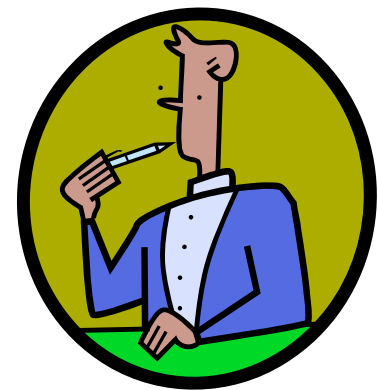
BOEs for Acquisition

- **A BOE for an acquisition project must consider all the costs associated with the work to be done:**

  - **Includes work being done on the government side such as:**

    - Managing the acquisition

    - Quality assurance for the government and contract activities

    - Acceptance of products

    - Management (and/or) development of requirements

    - Configuration management and data management of contract-related materials and products delivered or received

  - **Includes the in-house estimates for the acquired items or services**

    - The in-house estimate would look like a BOE done from the contractor's point of view

Essential Elements of a BOE
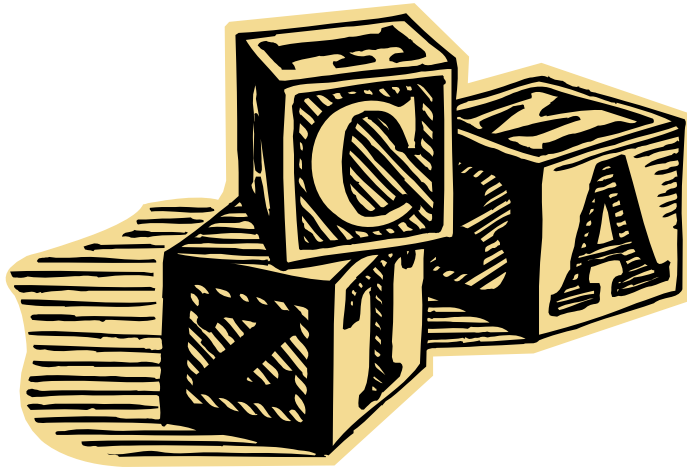
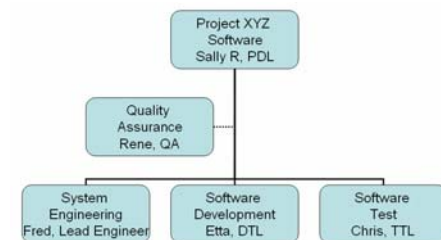- **Background on project**

- **Ground rules and assumptions**

- **Methodology summary**

- **Estimate description based on WBS elements and attributes of products**

- **Cost Estimate Summary**

- **Cost Traceability (for subsequent estimates)**

BOE Elements - Background

- **Include the following:**
  - **Objective of project**
  - **Organization of project**
  - **Brief technical description**
  - **Scope (WBS elements)**
  - **Project schedule**
  - **Acquisition strategy**
  - **Description of estimating team**

- **Include any assumptions to be used in estimations, e.g.,**

  - **Design considerations (amount of reuse or similarity to existing systems)**

  - **Price catalogs or rates**

  - **Management plans or strategies that affect costing**

  - *Any existing items* **or facilities to be used**

- **Include discussion of items that are NOT included in estimate**

BOE Elements - Methodology Summary

- **Summarize primary estimation methodology used:**
  - **Based on estimation models**
  - **Based on comparison with historical data (e.g. IMDC data, history on previous releases or CRs)**
  - **Based on analogy with previous systems or spacecraft**
  - **Estimation tool used (Slim, SEER-SEM, etc.)**
  - **Expert opinion (Wide Band Delphi Method)**
- **Should use more than one estimating method**
- **Identify initial risks and potential mitigation plans**
  - **Estimates should be adjusted for high risk factors**
  - **Mitigation plans should be costed and included in estimates**

BOE Elements - Estimate Description

Show (and retain) your Work!!!!

- **For each WBS element estimated, show detail of cost estimate:**
  - Use attributes of products such as lines of code, pages of documents, numbers of audit hours, etc.
  - List labor rates, describe how labor hours are derived
  - List purchases and prices, travel and training costs, facilities costs
  - If analogy is used, numerical comparisons must be used (30% larger, etc.)
- **If cost models are used, describe how they were applied**
- **If cost estimation tools are used, list input parameters with justifications**
- **Describe any cost adjustments made for risks**

BOE Elements - Cost Summary

- **Summary should summarize the detailed high - confidence estimate**

- **You may want to provide "bracketed" estimates:**

  - **Best case: low estimate**

  - **Most likely case: BOE estimate**

  - **Worst case: high estimate**

BOE Elements - Cost Traceability

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- **When a prior cost estimate exists, prepare a cost trace:**

Cost Element	Current Estimate	Prior Estimate	Change	%	Reason for Change
Element 1					
Element 2					
Element 3					
Element N					

SPI Awareness Session - Basis of Estimate   14

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- **For projects doing maintenance:**

  - **Yearly estimates can be based on estimation of change requests, BUT:**

    - Need to have good justifications

    - Including historical information, attributes

  - **If you have a yearly fixed amount of funding, then you should document your assumptions and your method of estimating and prioritizing the work to be performed**

- **BOEs should be updated if estimates change (or if information estimates are based on change)**

- **Current proposal and planning process encourages/ demands under-estimating in early stages of lifecycle**
  - **Enter risks for under-estimations**
  - **De-scope or enter risks if allocated budget is less than your estimate**
- **Optimistic assumptions with respect to**
  - **Ability to reuse/inherit existing software**
  - **Availability of new technology and products**
  - **Stability and understanding of requirements**
  - **Newness**
    - Anything you do for the first time will cost more than you expect

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- **Classic "I Forgot"s**
  - **Basic management, process, and coordination activities**
  - **Review preparation**
  - **Documentation**
  - **Training**
  - **Effort for change requests and error fixes**
  - **Support for testing**
  - **Maintenance**
  - **Mission Support Software Components**

BOE Tools and Artifacts

- **PAL has a Basis of Estimate Guide* - Contains a good descriptive list of items to be considered in generating your BOE.**

- **Artifacts:**

  - **All copies of BOEs and supporting materials (e.g. outputs of estimating tools)**

    - Be sure to include date of BOE

  - **Meeting minutes, records of discussions during generation of BOE**

- **Reminder: BOE materials are sensitive and should be properly secured**

* http://software.gsfc.nasa.gov/tools.cfm

Summary

- **The Basis of Estimate should document the methodology and detailed justifications for your cost estimates**

- **Include details of everything for which you will need funding**

- **Use a tool and/or historical information for estimating (Need numerical comparisons for analogy estimations)**

Questions?